NEW

PATENT SPECIFICATION

(11) 1 214 340

DRAWINGS ATTACHED

1 214 340

(21) Application No. 61814/68 (22) Filed 31 Dec. 1968
(31) Convention Application No. 735 007 (32) Filed 6 June 1968 in
(33) United States of America (US)
(45) Complete Specification published 2 Dec. 1970
(51) International Classification G 11 b 7/24
(52) Index at acceptance
G5R 51B7U 51B7Y 53C1 53CY 54C1D2 54C1DY 54C1Y 54CY 55B1 55B2A 55B2Y 55BU 55BY 56X7T
B6J 7A6 A2
C7F 1V1 2A 4N 6E2

(54) VIDEO RECORD DISC AND PROCESS FOR MAKING SAME

(71) We, GAUSS ELECTROPHYSICS, INC., a Corporation organised and existing under the laws of the State of California, United States of America, of 1653 Twelfth Street, Santa Monica, California, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention is related to the optical recording of video signals, and in particular, to an optical video disc provided with a helical groove optically modulated by groove video modulation corresponding to the video information being recorded. The invention is concerned with such a video disc record, and with a duplication process by which a multiplicity of such records may be mass-produced from a master record die. The process to be described, for example, is one in which the video information is embossed into a surface of the video disc record, rather than being stamped or molded into the surface. The material of the disc record surface is made such to be appropriate for embossing and to enable, under suitable temperature conditions, a slight force pressing the disc surface against a master die to cause the impressions on the surface of the die to be embossed into the surface of the dsc. With such an embossing process, thereis no transverse flow of the disc material, as occurs in the usual prior art stamping or molding processes, as are presently being used in the production of phonograph sound records, for example, and by which the actual surface of the record is raised above its melting point.

A video disc record blank of laminated transparent plastic construction may be provided, the laminated record having a surface layer of relatively soft transparent plastic of any suitable known type, and which can be readily embossed; and a supporting base of a rigid plastic, such as an acrylic resin or polyvinyl chloride. As a first step in this approach, the laminated disc record blank is heated to a point at which the surface tension of the surface material causes the surface to be smooth and regular. This temperature is the critical temperature at which embossed impressions may be formed on the disc surface, and it is below the melting point of the surface material.

The embossing die is heated to a temperature slightly above the critical temperature, and it and the record blank are brought together with a slight pressure. As the die and the record blank are brought together, the die is cooled to the aforesaid critical temperature, and its surface impressions are embossed into the surface of the record.

After the disc record has been embossed, as described above, an opaque mask is deposited into the portions of its surface around the resulting embossed microgrooves. This latter mask may be formed on the disc by using a vacuum deposition technique, as will be described.

The aforesaid disc record is laminated in order to present the desired surface characteristics for optimum embossing capabilities, and yet so that the record itself may be rugged and suitable for rough usage. The laminated structure of the record comprises reasonably tough and dimensionally stable clear plastic for the main body of the disc; and a plastic material on one surface of the disc which is most suited for embossing. The combination provides a video record disc which is useful, which can take an appropriate amount of handling, and which can be embossed easily and effectively.

Figure 1 is a perspective representation of a disc constructed in accordance with the concepts of the present invention, and by the process to be described, the disc being

shown as mounted on an appropriate turntable;

Figure 2 is a fragmentary representation of the disc shown in Figure 1, on an enlarged scale;

Figure 3 is a side section of the disc of Figure 1, taken essentially along the line 3—3 of Figure 1;

Figure 4 is a section of the disc shown in Figure 2, taken along the line 4—4 of Figure 2;

Figure 5 is a schematic representation showing the manner in which the impressions from a master die may be embossed into the surface of the disc record shown in Figures 1—4;

Figure 6 shows various steps in which a surface opaque layer may be deposited over selected portions of the embossed disc record.

The apparatus shown in Figure 1 includes a video disc record 10 constructed in accordance with the concepts of the present invention, and which has video signals recorded thereon for optical playback. The video signals are recorded on the disc 10, as will be described, in a recording track which extends as a micro-spiral from the outer periphery of the disc towards its center. The recording track on the disc 10 may have a width, for example, of the order of 1 micron, and the spacing between adjacent convoluitons of the dsic may also be of the order of 1 micron.

The video recording disc 10 is supported on a turntable 11 which, in turn, is rotatably driven by an electric motor 12. The motor 12 may rotate the turntable at a relatively high speed, for example, in the range of 900—3600 rpm.

The disc 10 may have a cross sectional configuration as shown, for example, in Figure 3. A metallic deposit is placed over portions of the upper surface of the disc 10, as designated 13 in Figures 2 and 4. As will be described, the disc 10 may have a laminated structure, shown in Figure 4, to be composed of a first portion 10*a* of a relatively hard transparent plastic, such as polyvinyl chloride; whereas the upper portion 10*b* may be of a relatively soft transparent plastic which is suitably embossed with the aforesaid micro-grooves.

The metallic deposit 13 is selectively placed on the high relief portions of the surface of the layer 15, after the surface has been embossed, so that the video recordings appear as discontinuous micro-grooves in which the transparency is retained, and which extend along a spiral recording track.

As mentioned above, the duplication process contemplated, by which plastic record discs are formed on a mass production basis from a master die, is one in which embossing is used. In carrying out the embossing process as shown in Figure 5, a plastic blank disc 100 attached to a diaphragm 102 in a suitable compartment *104*.

The disc 100 is constructed in the manner described above, so as to have a surface layer of relatively soft plastic material. The disc in the chamber 100 is then heated by any appropriate means to a critical temperature T1, which is such that the surface tension of the material forming the surface layer of the disc 100 causes the surface to be smooth and regular.

A master embossing die 106 is also provided, and it is mounted in a fixed position facing the plastic disc 100. The master die is then heated to a temperature which is slightly above the aforesaid critical temperature. The diaphragm 102 is then moved by fluid pressure, or by a ram, to bring the disc 100 against the embossing face of the master die 106. The temperature of the die is cooled back to the critical temperature. When the pressure is removed from the diaphragm 102, the attached disc 100 moves back from the die 106, with the impressions of the die being embossed on the surface of the disc; but without causing either abrasion of the embossing die, or loss of information due to surface tension of the plastic material. The use of the diaphragm 102 prevents any minute side motion between the disc 100 and the die 106, as the disc is moved against the die.

If necessary, a slight vacuum pressure may be used at the end of the embossing operation to move the disc 100 back from the surface of the die 106. In addition, or as an alternative, electrostatic means may be used, the diaphragm 102 and master die 106 being metal, to cause these two members to move together and achieve the desired embossing action. For example, the master die 106 may be formed of tungsten steel, and the diaphagm 102 may be formed of nickel. Then, the two elements may be charged and discharged electrostatically, so as to bring the disc 100 against the face of the die 106, and subsequently to move the disc away from the die.

After the disc 100 has been embossed with the video information, for example, by the duplication process and apparatus of Figure 5, a metal, or other opaque mask, is deposited onto the surfaces above the embossed micro-grooves which are formed in the surface of the disc. As mentioned above, a method of achieving this is to use vacuum deposition and a shadow mask technique, as shown schematically in Figures 6A and 6B.

As shown in the schematic sketches of Figures 6A and 6B, the disc 100 is considered to be mounted on a suitable turntable in a vacuum deposition chamber. The

sources(s) of the radiated metal, such as aluminum, designated 20, is (are) offset from the center of the disc 100 and raised slightly above its surface, as shown. The angle formed between the surface of the disc 100 and of the radiated metal is designated in Figures 6A and 6B. If this angle is fairly small, then the radiated metal will be formed on the upper sides of the embossed grooves, first on one side as shown in Figure 6A, and then continuously around to the other side, as the record rotates, as shown in Figure 6B. Therefore, as the metal deposition process continues and as the record 100 rotates, a thin coating of metal will be formed over the top edges of the micro-grooves, and also on the upper lands and other high relief areas of the disc surface(s).

That is, if the disc 100 is held on a turntable, and if the turntable holding the disc is slowly turned, then on the first half revolution, and as shown in Figure 6A, all the inside edges of the grooves will receive one coatitng of metal on the half furthest from the source. Then, when the record has gone through the next half revolution, both sides of the groove will have received a continuous coating of metal around the edges of all the grooves, as shown in Figure 6B. As the process continues through several revolutions, the corners of the metal deposit sharpen, and provide a uniform opaque metal layer over the high relief areas of the disc surface. The process has the feature of increasing the optical contrast ratio by the presence of the metal, and by the fact that the grooves themselves are not coated at their bottoms.

While a particular structure and process has been described, modifications may be made within the scope of the appended claims.

WHAT WE CLAIM IS:—

1. An optically modulated video disc record formed of transparent material having micro-grooves in one surface thereof, and having an opaque coating selectively formed on portions of said surface other than the bottoms of said micro-grooves.

2. The video disc record defined in Claim 1 in which said opaque coating comprises a metal.

3. The video disc record defined in Claim 2 in which said metal is vacuum deposited on said disc.

4. The video disc record defined in Claim 1 in which said micro-grooves are embossed in the surface of said video disc record.

5. The video disc record defined in Claim 4 and which includes a lamination of relatively soft transparent plastic material adjacent said surface for receiving said micro-grooves, and further lamination of relatively hard transparent plastic material.

6. A method for forming optically modulated video recordings in a transparent plastic disc record which comprises: forming micro-grooves in one surface of said disc; and selectively forming an opaque coating on portions of said surface other than the bottoms of said micro-grooves.

7. The method defined in Claim 6 and which includes forming said opaque coating by rotating said disc and evaporating a metal onto said surface from a source of radiated metal displaced from the center of rotation of said disc and raised above its surface so that the radiated metal forms a predetermined angle with the surface of the disc.

8. The method defined in Claim 6 in which said micro-grooves are formed by an embossing action by an embossing die.

9. The method defined in Claim 8 and which includes heating said disc and said die to a predetermined temperature.

10. The method defined in Claim 8 and which includes embossing said micro-grooves in said surface by affixing said disc record to a diaphragm and forcing said diaphragm against a surface of said die.

11. The method defined in Claim 10 and which includes exerting a fluid pressure against said diaphragm to drive said disc against said die.

12. The method defined in Claim 10 and which includes exerting a vacuum pressure against said diaphragm to draw said disc away from said die.

13. The method defined in Claim 6, wherein said micro-grooves extend along a spiral track from the outer periphery of the disc towards its centre and correspond to the signals to be recorded.

POTTS, KERR & O'BRIEN.

Reference has been directed in pursuance of Section 8 of the Patents Act, 1949, to Specification No. 1,153,810.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1970.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

1214340 COMPLETE SPECIFICATION
1 SHEET This drawing is a reproduction of the Original on a reduced scale

Fig. 1

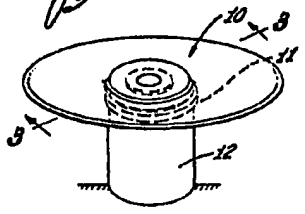

Fig. 2

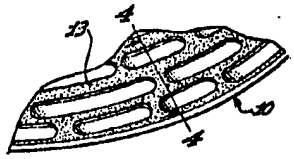

Fig. 3

Fig. 4

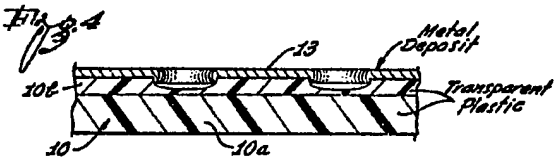

Fig. 6

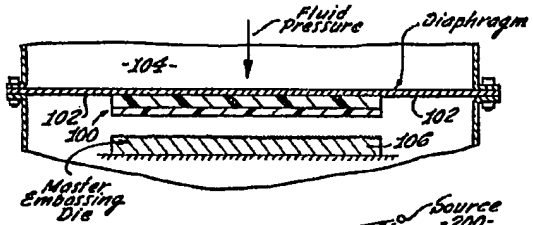

Fig. 6